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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/602,596	06/25/2003	Wataru Saito	239400US2S	1453

22850 7590 05/21/2004

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EXAMINER	
OWENS, DOUGLAS W	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 05/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/602,596	SAITO ET AL.	
	Examiner	Art Unit	
	Douglas W Owens	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-7 and 9-15 is/are rejected.

7)☒ Claim(s) 8 and 16-20 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 6/25/03.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper. Applicant is required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or a practitioner representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1 – 7 and 9 – 15 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent No. 6,693,338 to Saitoh et al.

Regarding claim 1, Saitoh et al. teach a power semiconductor device (Fig. 2, for example), comprising:

a first semiconductor layer (11) of the first conductivity type;

a second semiconductor layer (19) of the first conductivity type and a third semiconductor layer (18) of a second conductivity type which are alternately and laterally arranged on the first semiconductor layer;

a first main electrode (16) in electrical contact with the first semiconductor layer;

a fourth semiconductor layer (12) of the second conductivity type selectively formed in surface regions of the second and third semiconductor layers;

a fifth semiconductor layer (13) of the first conductivity type selectively formed in a surface region of the fourth semiconductor layer;

a second main electrode (17) formed in contact with surfaces of the fourth and fifth semiconductor layers; and

a control electrode (15) formed on surfaces of the second, fourth and fifth semiconductor layers,

wherein an impurity concentration of the first semiconductor layer is lower than that of the second semiconductor layer (Col. 8, lines 9 – 20; Col. 10, lines 26 – 30) and a layer thickness ratio A is given by an expression:

$$0 < A = t/(t+d) \leq 0.72$$ (Col. 8, lines 5 – 7)

where t is a thickness of the first semiconductor layer, and d is a thickness of the second semiconductor layer.

Regarding claim 2, Saitoh et al. teach a semiconductor device, wherein, assuming an aspect ration B is represented by B = d/w (d = 20 microns, for example; Col. 8, lines 18 – 20), where w is an interval between adjacent third semiconductor

layers (w = 8 microns, for example; Col 8, lines 20 – 21), the layer thickness ratio A (A = 0.21, for example; Col. 8, lines 5 – 7) and the aspect ratio B (B = 2.5) satisfy an expression below:

$A \times B \leq 1.15$,

since $A \times B = 0.525$.

Regarding claim 3, Saitoh et al. teach a semiconductor device, wherein an aspect ration B and the layer thickness ration A satisfy an expression below:

$-0.04B + 0.48 < (A \times B) < 0.13B + 0.59$.

since 0.38 (left term) is less than 0.525 (middle term), which is less than 0.915 (right term).

Regarding claim 4, Saitoh et al. teach a device, wherein A x B satisfies the relationship;

$0.58 < (A \times B) < 0.71$,where A = 0.25, for example (See. Col. 8, lines 5 – 7).

Regarding claim 5, Saitoh et al. inherently teach a device, wherein assuming that a breakdown voltage is represented by VB; then VB, t, B and A satisfy the relationship,

$t < 2.53 \times 10^{-6} \times (A \times VB)^{7/6}$ (cm), since the device disclosed by Saitoh et al. is identical to that of the instant application. Moreover, Saitoh et al. teach the optimal thickness, t as disclosed on page 17 of the instant application, in lines 20 – 31 of column 11.

Regarding claim 6, Saitoh et al. inherently teach a device, wherein Nn, VB and A satisfy the relationship,

$Nn > 1.11 \times 10^{18} \times (A \times VB)^{-4/3}$ (cm^{-3}), since the device disclosed by Saitoh et al. is identical to that of the instant application. Moreover, Saitoh et al. teach the optimal impurity concentration of the first semiconductor layer, as disclosed on page 17 of the instant application, in lines 10 and 11 of column 8.

Regarding claim 7, Saitoh et al. teach a device (Fig. 6), wherein an insulating material (22) is interposed between the second and third semiconductor layers.

Regarding claims 9 – 15, Saitoh et al. teach a device, wherein an impurity concentration profile at least one of the second semiconductor layer and third semiconductor layer reduces with depth. This feature is shown in Fig. 4c, where the impurity concentration gradually reduces near the junction with the first semiconductor.

Allowable Subject Matter

4. Claims 8, and 16 – 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 571-272-1662. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Douglas W. Owens
Patent Examiner